# AN ATTEMPT TO PREDICT SUBJECT RETENTION RATES IN A LONGITUDINAL STUDY USING ACE SCORES

By

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A thesis submitted to Johns Hopkins University in conformity with the requirements for the degree of Master of Science

Baltimore, Maryland

May 2019

## Abstract

Adverse Childhood Experiences (ACEs) are rapidly gaining the attention of researchers, as well as other professionals across the country as more and more links between ACEs and health outcomes are found. Research has shown connections between ACEs and health problems, both physical and mental, in adults. While a person may experience ACEs as a child, the toxic effects have far reaching consequences throughout their adult lives.

Longitudinal studies depend on a subject's participation in several sessions throughout a long period of time, participating in multiple sessions. For many studies, subject participation becomes problematic. This study investigates the relationship between ACEs and the attendance rates of the Legacy for Children Project evaluation piece conducted by researchers at Oklahoma State University. It is the hope, that with the information offered, researchers might be able to adjust their assessment methods, contact efforts, and resources offered to help boost their retention rates.

The assessment of ACEs was done through subjects filling out a 10-question questionnaire at their second visit with researchers. Their ACE score is calculated by adding their number of "yes" answers to the questionnaire, with the highest possible score being 10, the lowest possible score being 0. This study found that there were no significant relationships between the sample's ACE scores and their assessment attendance.


Thesis Readers: Dr. Jeffrey Kantor

## Table of Contents

## Index of Tables

## Index of Figures

## Introduction

When conducting longitudinal research, one of the most common problems encountered is the attrition and retention of the research participants over time. Inevitably, there will be participants who researchers will no longer be able contact. Attrition happens for a variety of reasons. Participants may decide to discontinue their participation in the study, or the participant might pass away, become incarcerated, experience severe illness or a variety of other things that will make their continued participation in research either very difficult so they don't continue, or it is impossible, as in the case of death or moving out of state. These all fall under the umbrella of attrition, which refers to the gradual loss of participants across the research study.

For best results, it is critical for researchers conducting a study to retain their participants for the duration of the study. It is a common belief that a study needs to retain at least 30% of its original sample in order to produce relevant and reliable results.[1] The retention goal that many studies commonly strive for is to retain at least 80% of the original sample. This helps to ensure that there are enough participants in the sample for strong analysis of the data, helping to show that there is variation among the sample to build the case for more meaningful results.[2]

When working with at risk populations, retention can suffer tremendously. Participants from low-income populations tend to move often, with housing vouchers providing the means to move into a neighborhood that is perceived to be better, or a house that will better accommodate the family size.[3] While there seems to be a lack of research on the percentage of low income

[1] McLellan, A., Woody, G., Metzger, D., McKay, J., Durell, J., Alterman, A., & O'Brien, C. (1996). Evaluating the Effectiveness of Addiction Treatments: Reasonable Expectations, Appropriate Comparisons. *The Milbank Quarterly, 74*(1), 51-85

[2] Cantrell, J., Bennett, M., Thomas, R. K., Rath, J., Hair, E., & Vallone, D. (2017). It's Getting Late: Improving Completion Rates in a Hard-to-Reach Sample. *Survey Practice,11*(2).

[3] Basolo, V., & Yerena, A. (2017). Residential mobility of low-income, subsidized households: a synthesis of explanatory frameworks. *Housing Studies*, *32*(6), 841–862.

populations that switch mobile phone carriers or change phone numbers, experience working within this population has shown that low income populations tend to frequently have phone numbers that are not working at the time of follow up. This often means that the participants have switched phone carriers and have acquired new phone numbers between points of contact, making it more difficult to get in touch with them over the course of the research study.

While some of these reasons for attrition are unavoidable, there are actions that researchers can take to help improve the retention of their participants. Many studies have employed the use of a variety of techniques to help increase the retention of participants, including incentives of increasing value at each visit, various forms of consistent contact for continued participation including mailers, emails, phone calls, and text messages. Often it is found that the incentives are helpful in retaining participants and is cited by the participants as a reason for continued participation in the study, however, methods for the successful recruitment of each individual participant have been shown to vary.[4] Essentially, what works for one person, might not be effective for another. A high value is also placed on putting efforts into tracking participants and their information for the duration of the study.[5] Other studies have shown that it is not just one recruitment method that has been found to be effective, it is a combination of methods including phone calls, texts, and emails that has shown promise in improving retention rates.[6]

[4] Boys, A., Marsden, J., Stillwell, G., Hatchings, K., Griffiths, P., & Farrell, M. (2003). Minimizing respondent attrition in longitudinal research: Practical implications from a cohort study of adolescent drinking. *Journal of Adolescence,26*(3), 363-373.

[5] Morrison, T.C.,Wahlgren, D. R., Hovell, M.F., Zakarian, J., Burkham-Kreitner, S., Hofstetter, C. R., Slymen, D. J., Keating, K., Russos, S., Jones, J. A. (1997) Tracking and follow-up of 16,915 adolescents: Minimizing attrition bias, *Controlled Clinical Trials*, Volume 18, Issue 5, Pages 383-396, ISSN 0197-2456.

[6] Booker, C. L., Harding, S., & Benzeval, M. (2011). A systematic review of the effect of retention methods in population-based cohort studies. *BMC Public Health*, *11*(1), 249–260.

In this study, we will be exploring the retention rates of mothers who are participants in the Legacy for Children program, offered in both English and Spanish, and the control group as well. The Legacy for Children program is a parenting intervention program created by the Center for Disease Control, focusing on providing parenting resources to low income families to improve the outcomes for their children. Participants in the Legacy for Children program were asked to participate in a parenting group that included 9 blocks of 10 weeks of material presented over the course of 3 years. The participants in the Legacy for Children program, as well as the control group were also asked to participate in periodic assessments over the 3 years in which they would answer survey questions including but not limited to topics about their child's development, parenting beliefs, and employment and education status. At the time of recruitment, participants were given the choice of participating in the parenting group, as well as the assessments for 3 years (treatment group), or just participating in the assessments over the 3 years of the study (control group). The only requirements for being able to participate in the study were that they be eligible to receive services from Women, Infants, and Children (WIC), have a child age 0-3 months, and expect to stay in the Tulsa area for the next 3 years.

Participants in the study were recruited from a variety of different areas throughout the Tulsa area. Many were recruited from Emergency Infant Services, Oklahoma State University Pediatrics (OSU Peds), Catholic Charities, and ChildrenFirst. The majority of English treatment participants for the were recruited from Emergency Infant Services, and the English control group primarily came from OSU Pediatrics. The Spanish treatment group were primarily recruited from Catholic Charities in Tulsa, and the Spanish control group from OSU Pediatrics, Catholic Charities, and friend referrals.

All of these providers cater to low income families, providing resources to the community. In order to access these services, the participants were in desperate need of services at the time of accessing the providers, thus bolstering the idea that many of the participants would have a high ACE score.

When looking at the retention rates for this particular study, they are much lower than comparable studies that have been conducted at OSU Tulsa. In other studies being conducted at our institution that involve low-income populations, the studies have been able to maintain an 80% or higher retention rate. This led to the question, what is it about this population of people that makes it difficult to retain them?

Other parent intervention studies have offered some possible reasons for a lack of parent retention. One study concluded that parents were more likely to stay involved in a research study if it involved their children, rather than a deeper focus on the parent.[7]Another study had a single parent intervention component and multiple child intervention components. While the child retention rates were good, parents attended just over half of the parenting classes.[8] Some studies have also found connections between parents' belief in the benefits of the research and retention. Links between parent education and research participation have also been found, showing those with a lower level of education are less likely to participate in research studies for their entirety.[9]It is not believed that either of these latter two explanations is the case with the sample being investigated, as parents were explained the goal of the research and understood the value

[7] Heinrichs, N., Bertram, H., Kuschel, A., & Hahlweg, K. (2005). Parent Recruitment and Retention in a Universal Prevention Program for Child Behavior and Emotional Problems: Barriers to Research and Program Participation. *Prevention Science*, *6*(4), 275–286

[8] Barrera, M., Biglan, A., Taylor, T.K. et al. Prev Sci (2002) 3: 83

[9] Spoth, R., Redmond, C., & Shin, C. (2000). Modeling factors influencing enrollment in family-focused preventive intervention research. *Prevention Science, 1*(4), 213-25.

of the parenting classes and participating in the research as they all showed an interest in learning more about parenting.

This thesis will explore another possible cause contributing to the loss of participants in this study – Adverse Childhood Experiences. Adverse Childhood Experience are commonly referred to as ACEs. ACEs encompass a broad spectrum of trauma that children experience, including but not limited to, experiencing or witnessing physical abuse and/or sexual abuse, divorce, food instability, parents with depression or other mental illness, parent incarceration, etc. The higher the number of ACEs a person experiences, the higher the level of risk for lasting negative effects into adulthood.[10] ACEs have been shown to effect memory, planning skills, and overall health outcomes lasting into adulthood. In the Legacy for Children program, the comparison group had relatively high retention rates when compared with the treatment group, even though the comparison group fell below the 80% retention rate goal by the end of the study. This could be due to Protective and Compensatory Experiences, referred to as PACEs. PACEs can include having a best friend as a child, knowing you were loved unconditionally, having a fulfilling hobby, involvement in group activities like sports, art, or drama clubs, etc. These PACEs can often act as a buffer against the ACEs that children experience.

It was hypothesized that the population of participants in the Legacy for Children program, as well as the control group had high level of ACEs and this would affect their participation in the full longitudinal study, lasting over a period of 3 years. It was also hypothesized that there were some among the population that, while they did have a high level of

[10] Center on the Developing Child (2010). *The Foundations of Lifelong Health Are Built in Early Childhood*.

ACE scores in their childhood, they will also have a high level of PACEs to counteract these effects.

By showing a predictive relationship between these concepts and applying that to what we know about retention among low-income populations, it may be possible that future research studies could come up with innovative ideas for providing resources to participants in research that could increase participation and retention for the duration of the study. The following literature review explains in depth the concept of ACEs and PACEs and how this can relate to participants in low-income populations, and could be applied to other at-risk populations as well.

## Review of Literature

### ACEs History and Effects

Adverse Childhood Experiences (ACEs) were identified in 1985 while investigating the cause of attrition among research participants in an obesity study conducted by Dr. Vincent Felitti in San Diego, California. It was further investigated by the Center for Disease Control and Dr. Felitti in a study lasting from 1995-1997. This original study used an ACE questionnaire to evaluate childhood exposure to physical abuse, sexual abuse, mental abuse, drug use, poverty, and criminal behavior in the household, as well as parental mental health[11]. The original questionnaire consisted of seventeen questions; This study used a version that has been narrowed down to ten commonly used questions, although there are other questions that have been added including those dealing with immigration for the Spanish group, those were not included in this analysis.

[11] Original ACEs Questionnaire 1998

In the original study conducted by Dr. Felitti found a strong connection was found between exposure to Adverse Childhood Experiences and major health problems later in life, including heart disease, lung disease, and liver disease, among many other health problems.[12] Exposure to multiple ACEs was also related to inhibited brain functions such as memory problems.[13] Adults with high ACE scores also have been shown to have decreased emotion regulation skills, which leads to more psychological distress in adulthood.[14]

Having an ACE score of four or more has been shown to have significant negative effects on children's learning and behavior outcomes[15]. Being at risk for these negative outcomes as a child can have an impact on children as they move into adulthood. Those with an ACE score of 4 or more are less likely to attain a college degree or other form of education after high school, as well as more likely to be employed in a low wage job.[16] This is a contributing factor in the number of people with high ACE scores that continue to live in poverty. A person living in poverty naturally has less access to resources that might be necessary for participation in a research study such as access to transportation or childcare.

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[12] Felitti, V.J., Adna, R.F., Nordenberg, D., Williamson, D.F., Spitz, A.M., Edwards, V., Koss, M.P., Marks, J.S. (1998).Relationship of Childhood Abuse and Household Dysfunction to Many of the Leading Causes of Death in Adults: The Adverse Childhood Experiences (ACE) Study. *American Journal of Preventive Medicine V 14 issue 4, 245-258.*

[13] Brown, D. W., Anda, R. F., Edw-ards, V. J., Felitti, V. J„ Dube, S. R„ & Giles, W. H. (2007). Adverse childhood experiences and childhood autobiographical memory disturbance. *Child Abuse and Neglect, 31, 961-969.* doi: 10.1016/j.chiabu.2007.02.011

[14] Rudenstine, S., Espinosa, A., Mcgee, A. B., & Routhier, E. (2018). Adverse childhood events, adult distress, and the role of emotion regulation. *Traumatology*. http://dx.doi.org/10.1037/trm0000176

[15] Burke, N. J., Hellman, J. L., Scott, B. G., Weems, C. F., & Carrion, V. G. (2011). The impact of adverse childhood experiences on an urban pediatric population. *Child Abuse & Neglect,35*(6), 408-413.

[16] SmartDiana, Youssef, G. J., Sanson, A., Prior, M., Toumbourou, J. W., & Olsson, C. A. (2017). Consequences of childhood reading difficulties and behaviour problems for educational achievement and employment in early adulthood. *British Journal of Educational Psychology*, *87*(2), 288–308.

Exposure to ACEs is also related to diminished executive functioning in the brain, which involves inhibitory control, and working memory.[17] Executive functioning involves areas of the brain responsible for planning, staying with a task until it is finished, organizing, and realizing that there is more than one way to solve a problem.[18]

Poverty and a lack of executive functioning skills can also affect families as they struggle to pay their bills, and feed and clothe their families. Inhibitory control and working memory skills are components of executive functioning that are needed in order to be able to spend money and resources where they will be of the most benefit to the family. This can often lead to changing of homes, changes in phone numbers, and a lack of access to the internet. Consistency in these areas is necessary for researchers to have contact research study participants over a long period of time.

When considering the life skills required to participate in a research study, especially a longitudinal study, executive functioning encompasses many of the skills that would enable a participant to successfully participate in the entirety of the study. These skills can include planning for and keeping appointments with the researchers, organizing your day to fit in an appointment that is not usually in occurrence, as well as working around other barriers to get to the research study. Therefore, those with diminished executive functioning would have difficulty planning for and keeping appointments, and managing schedules to work around unexpected changes to their day, causing them to miss scheduled appointments with researchers, as well as difficult to get ahold of if they have not paid their phone bill on time.

[17] Ji, S., & Wang, H. (2018). A study of the relationship between adverse childhood experiences, life events, and executive function among college students in China. *Psicologia: Reflexão e Critica*, *31*(1), 1.
[18] Understood.org. 2019. Accessed 3/19/2019.

**PACEs and Their Effects**

While ACEs have been shown to have negative impacts throughout adulthood, there are other things that have been shown to mitigate that risk. These experiences are known as protective and compensatory experiences (PACEs). Dr. Jennifer Hayes-Grudo and Dr. Amanda Morris presented a 10-question questionnaire at a conference in 2015 outlining several common protective factors that children could experience that would buffer the effects of exposure to ACEs.[19] It has been shown that providing experiences that minimize the effects of ACEs promotes healthier brain development and overall more positive health outcomes in children that can last into adulthood.[20] This study hypothesizes that these protective experiences will be related to longer participation in a longitudinal study, even in the presence of ACEs.

There are a variety of PACEs that have a positive effect on the developing child, that decrease the negative effect of ACEs. Trusted adult support is one of the major contributors when looking at protective and compensatory experiences.[21] It has been found that children need the support of adults to help them develop their coping skills and responses to excessive stress[22], skills that will stay with them as they develop into adults. These coping skills, showing strength in the face of adversity, are often called resilience.

[19] Hays-Grudo, J., Morris, A.S. (2015). Protective and Compensatory Experiences. *Society for Research in Child Development Poster.*

[20] Sege, R.D., Harper Browne, C. (2017). Responding to ACEs With HOPE: Health Outcomes From Positive Experiences, *Academic Pediatrics*, 17 (7), Pages S79-S85.

[21] Bellis, M. A., Lowey, H., Leckenby, N., Hughes, K., & Harrison, D. (2014). Adverse childhood experiences: retrospective study to determine their impact on adult health behaviours and health outcomes in a UK population. *Journal of Public Health*, *36*(1), 81–91

[22] Shonkoff, J. (2012). Leveraging the biology of adversity to address the roots of disparities in health and development. *Proceedings of the National Academy of Sciences of the United States of America, 109*, 17302-17307.

It has been shown through research that the biggest promoter of resilience, is relationships with other people.[23]Resilience in children has been studied in a variety of different situations and has been found to be an adaptive feature in children to assist them in dealing with stress. This resilience can be influenced by a number of different factors, but the most common are positive parenting and supportive relationships with adults, fostering positivity and competence that lasts into adulthood.[24]

Having a best friend is another contributing protective factor, and further promotes the idea that relationships are extremely important in promoting resilience. It has been found that adolescents who had the acceptance and support of a friend were less likely to internalize and externalize problems that resulted from ACEs, such as neglect.[25]

In addition to questions concerning relationships, the PACEs questionnaire also includes questions about involvement in extracurricular activities, or hobbies. Having a hobby is another factor that is listed as having a protective and compensatory effect against ACEs and it has been reported by those struggling with mental illness that holding employment, and learning a new task that they enjoy helps to improve their mental health.[26] Serving others, and having a clean home where the child's physical needs were met, are also included in the questionnaire.

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[23] Luthar, S. S. (2015). Resilience in Development: A Synthesis of Research across Five Decades. *Developmental Psychopathology,*739-795. https://doi-org.proxy1.library.jhu.edu/10.1002/9780470939406.ch20

[24] Masten, A. S. (2001). Ordinary magic: Resilience processes in development. *American Psychologist*, *56*(3), 227–238.

[25] Steinhausen, H.-C., & Metzke, C. W. (2001). Risk, compensatory, vulnerability, and protective factors influencing mental health in adolescence. *Journal of Youth and Adolescence*, *30*(3), 259–280.

[26] Onken, S.J., Dumont, J.M., Ridgway, P., Dornan, D.H., & Ralph, R.O. (2002). Mental Health Recovery: What Helps and What Hinders?

## Retention and Attrition

While some attrition is expected, it typically does not impede the analysis of the data and does not signify any biases. Significant factors contributing to attrition and retention rates are not an area that has been extensively researched. One study did find that minority women were more likely to discontinue participation than their counterparts, and older participants were more likely to drop out than the younger participants.[27] In reference to retention, it has been found that email is an effective way to contact participants if they do not have current and working phone numbers.[28]Other studies have found that emphasizing the fact that they are participating in a legitimate research study and not a scam can help to improve retention rates.[29]

## Problem Statement

As discussed in the previous paragraphs, ACEs and PACEs assess characterisitics that should be related to and predictive of participation in longitudinal research studies. Many longitudinal studies struggle to retain their participants over a long period of time. While some attrition is natural, researchers at this institution typically try to retain 80% of their participants, or have an attrition rate of less than 20%. The Legacy study being evaulated did not maintain an 80% retention rate at wave 2, just a few months after the collection of the baseline data. While many studies have investigated the methods that work to retain participants, very few have looked into a possible deeper cause for attrition. This study poses that participants who have an

[27] Boykin, D. M., London, M. J., & Orcutt, H. K. (2016). Examining Minority Attrition Among Women in Longitudinal Trauma Research. *Journal of Traumatic Stress*, *29*(1), 26–32.
[28] Stets, M., Stahl, D., & Reid, V. (2012). A Meta-Analysis Investigating Factors Underlying Attrition Rates in Infant ERP Studies. *Developmental Neuropsychology*, *37*(3), 226–252.

[29] Farrall, S., Hunter, B., Sharpe, G., & Calverley, A. (2016). What 'works' when retracing sample members in a qualitative longitudinal study? *International Journal of Social Research Methodology*, *19*(3), 287–300.

ACE score or 4 or more will be harder to locate and contact at subsequent data collection events, thus making it difficult to retain them.

## Research Methodology

Participants in the Legacy for Children program, as well as the control group were asked to come in a total of 7 times over the course of 3 years. During the second wave of data collection, participants in both the treatment and comparison groups were given the ACEs and PACEs questionnaires in addition to their regular surveys. The original questionnaires used can be found in Appendix 1 and 2. This was the practice for both Spanish and English participants. The ACEs and PACEs scores used in the analysis were collected at wave 2. The questionnaires require a simple yes or no answer, and the yes answers were then added up to get their total ACE and PACE score. Attendance was evaluated by adding up the total number of assessments attended over the 3-year period. Table 1 indicates the time line of assessments for all groups. The Shaded cells indicate data collected, the non-shaded cells indicate when data collection was not offered to the Spanish control group.

Table 1: Data collection time line

| Age in Months | English Treatment | English Control | Spanish Treatment | Spanish Control |
|---|---|---|---|---|
| 1-4 | | | | |
| 5-7 | | | | no data collection |
| 8-11 | | | | |
| 12-15 | | | | no data collection |
| 16-20 | | | | |
| 24-28 | | | | |
| 36-40 | | | | |

There were seven assessments throughout the study for the English treatment and comparison groups, and the Spanish treatment group. Due to difficulty recruiting and retaining the Spanish comparison group initially, the Spanish comparison group was only assessed at five different points over the 3 years. The Spanish comparison attendance rates were adjusted for the times attended, making their numbers match the 7 possible assessments for the other groups. Referring to table 1, if a Spanish comparison participant attended all possible assessments, they would receive a score of 7, if they attended the first two assessments but none after that they were given a score of 4, due to the fact that if they had been following the same time line as the others, they would have been to all 4 assessments. If the Spanish comparison group attended 3 sessions, they were given a score of 5, which is the timeline equivalent for the other groups as well. It is important to note that the total number of participants consented in to the study is different from the sample size of data used; this is because some participants did not return to the study after their initial baseline survey, and the ACEs and PACEs measures were administered during the second wave of data collection. This is discussed in detail in the limitations section. Table 2 shows the sample of data collected, as well as the percentage of participants from each group that completed the ACEs and PACEs questionnaires.

Table 2: Sample and percentage breakdown

| | Sample data Analyzed | Percentage of participants with completed data |
|---|---|---|
| English Treatment | 18 | 58% |
| English Comparison | 32 | 84% |
| Spanish Treatment | 18 | 60% |
| Spanish Comparison | 25 | 83% |
| **Totals** | **93** | **72%** |

## Results

The retention rates for this research study are very low despite the use of various methods to contact participants. In accordance with the recommendations for retention methods currently available, the study employed phone calls and text messages to participants, emails, letters in the mail, as well as contacting friends and family provided by the participants to get updated contact information, as well as reaching out over Facebook Messenger. Yet, at the end of the study, the retention rates for the treatment group are still very low, which is the opposite of what is typically expected based on involvement with other studies.

The comparison groups had lower retention rates as well, but not as low as would be expected, given the rates of the treatment group. In other studies I have been involved with it is typical to see lower retention rates among the control groups. Original data for the English treatment and comparison group as well as the Spanish treatment group was gathered when the target child reached the following ages: 0-4 months, 5-7 months, 8-11 months, 12-15 months, 16-20 months, 21-26 months, 26-30 months, and 36-40 months. Spanish comparison used a slightly different scale as there was difficulty recruiting participants and following up with them for future data collection. The data points shown are the points that all elements of the study have in common. Figure 1 shows retention rates at different waves of the study broken down by English and Spanish, treatment and comparison groups. Figure 2 shows the retention rates for the combined English and Spanish treatment and comparison groups.

Figure 1: Retention rates for English and Spanish groups, treatment and comparison

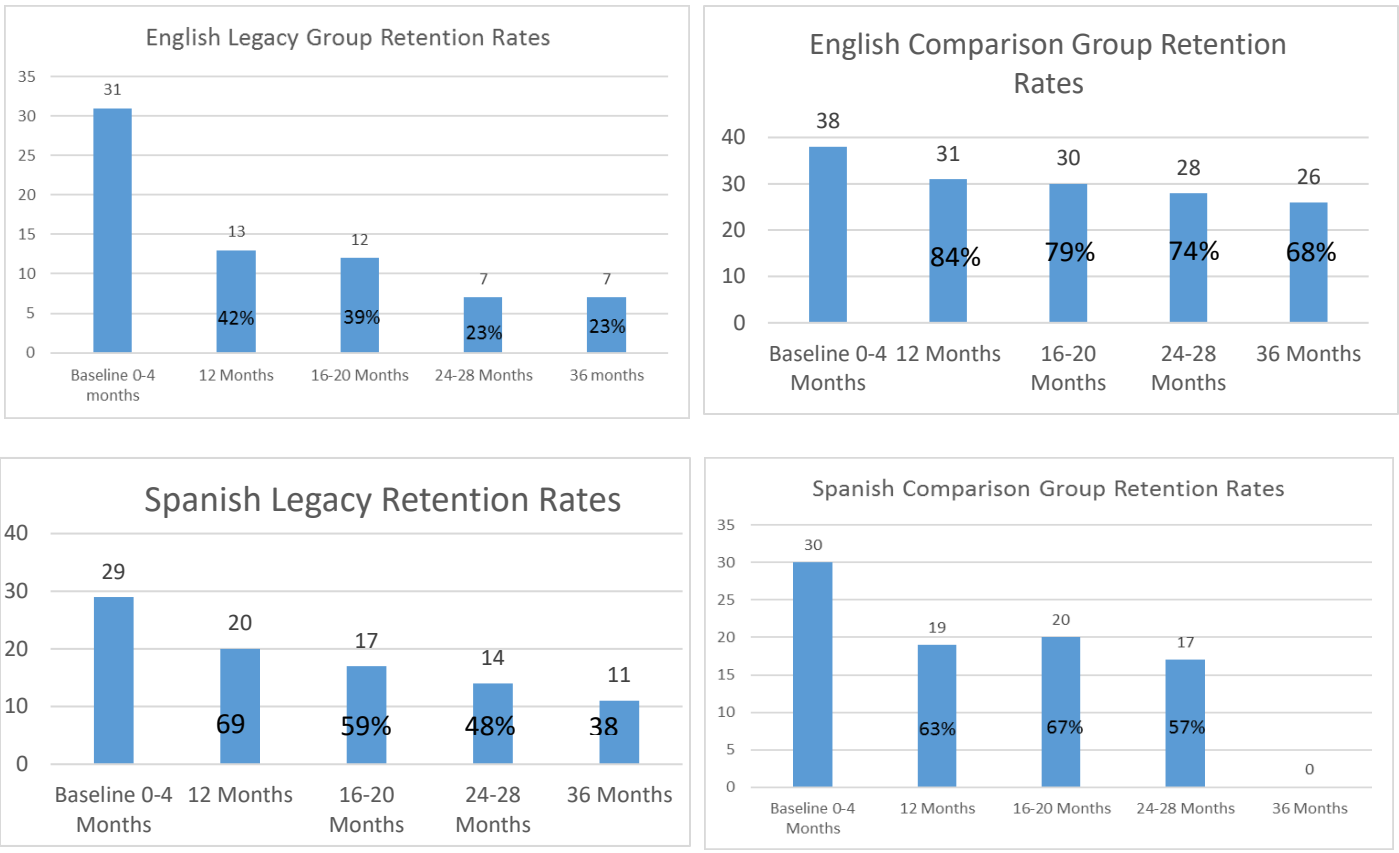
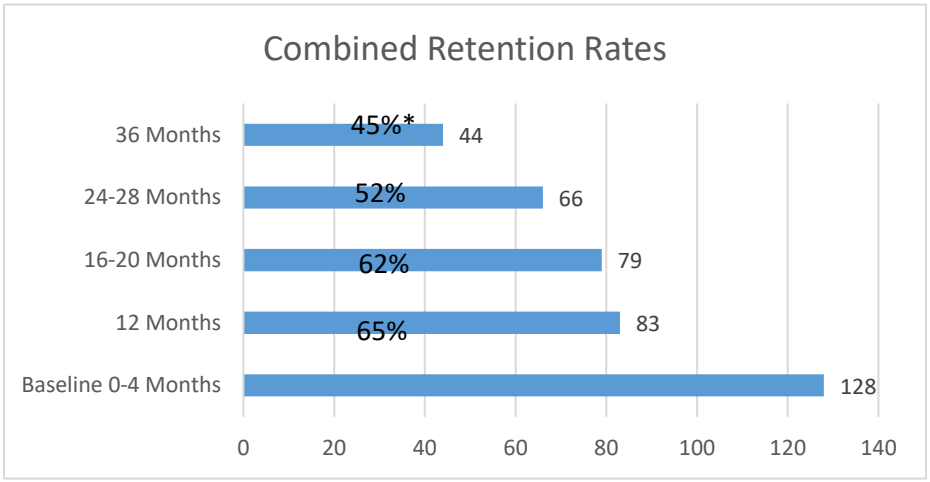



Figure 2: English and Spanish combined group retention rates



It is important to note that the 36-month data collection has not occurred for the Spanish comparison group, therefore the Spanish comparison group was not included in the retention rate calculation in the Spanish comparison group, as well as the combined retention rates.

The descriptive statistics for the sample are included in Figure 3, separating the ACE variable and the PACE variable. These descriptive statistics figures represent both the English and the Spanish samples together.

Figure 3 Descriptive Statistics for ACEs/PACEs and attendance

**Descriptive Statistics**

| | Mean | Std. Deviation | N |
|---|---|---|---|
| Attendance | 5.84 | 1.644 | 93 |
| ACEScore | 2.27 | 2.683 | 93 |
| PACEscore | 7.32 | 2.341 | 93 |

The average attendance for English participants is 5.7 and for Spanish participants the average was 5.9. These are outlined in figure 5. The difference in means is not significant, shown in figure 4.

Figure 4: Spanish and English comparisons

**Spanish and English Statistics Compared**

| | Language | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| Attendance | English | 50 | 5.76 | 1.636 | .231 |
| | Spanish | 43 | 5.93 | 1.668 | .254 |

An Independent T test was run between the English and Spanish groups to determine if their means were equal and it was determined that there is not a statistically significant difference in the means of the English and Spanish groups at a 0.05 level of significance. This is illustrated in figure 5.

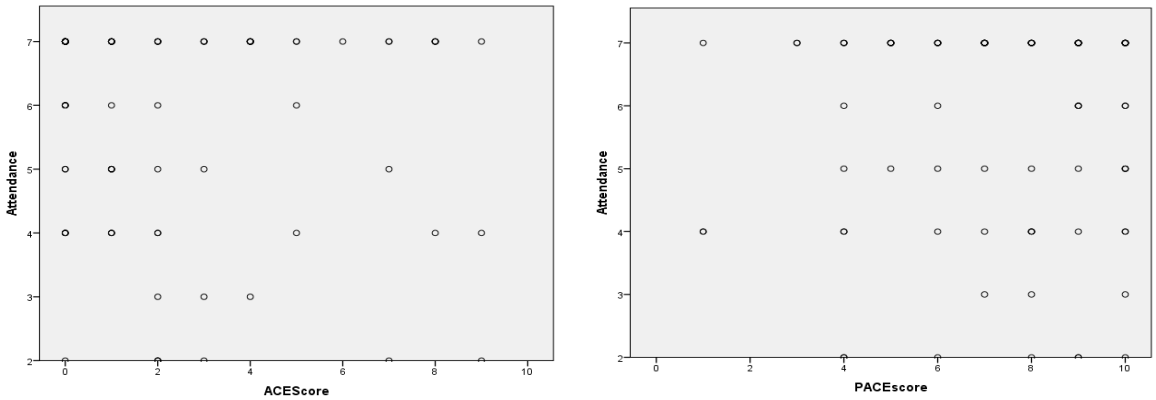
Figure 5: T test for significance

**Independent Samples Test for English and Spanish Groups**

| | | t-test for Equality of Means for English and Spanish groups | | |
|---|---|---|---|---|
| | | Sig. (2-tailed) | Mean Difference | Std. Error Difference |
| Attendance | Equal variances assumed | .621 | -.170 | .343 |
| | Equal variances not assumed | .622 | -.170 | .344 |

Initially a simple scatter plot test was used to visualize if there was a linear relationship between the participant's ACE scores, PACE scores, and the attendance rates of the participants. A linear relationship gives a visual indication that there is indeed a strong relationship between the variables, thus it should show a strong relationship between the ACE or PACE score and the attendance rates. First ACE scores and attendance scores were plotted for the entire sample N=93. There did not appear to be a strong linear relationship found in the analysis of both English and Spanish groups together. Shown in Figure 6

Figure 6: Scatter plots of English and Spanish groups combined



Since the groups together did not show a strong relationship to each other, it was decided to separate to groups In order to determine if there was a linear relationship when looking at English and Spanish groups separately. ACE scores were compared with attendance scores for the English and Spanish groups separately. N=50 and N=43 respectively. Neither of these scatter plots showed any strong linear relationship between high ACE scores and assessment attendance. Figure 7 shows the English group, and figure 8 shows the Spanish group.

Figure 7: English linear relationship scatterplot

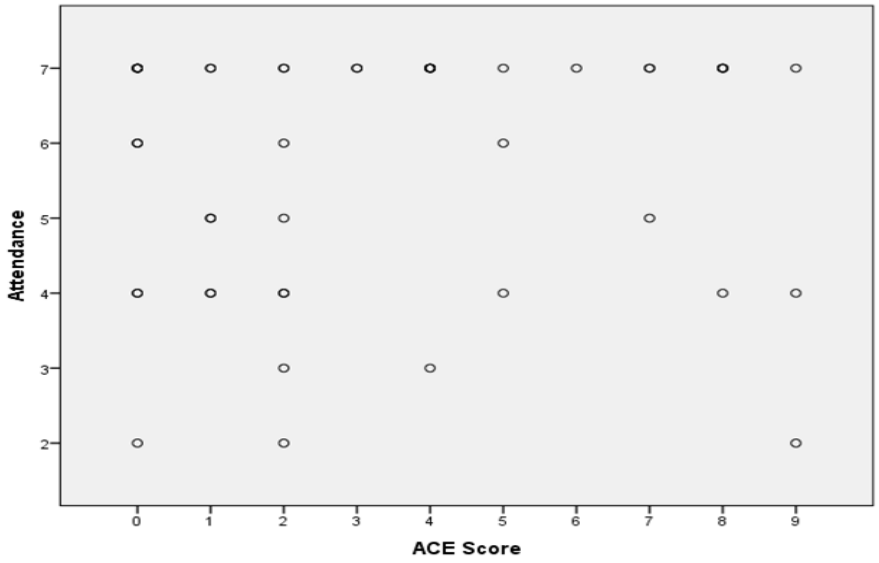
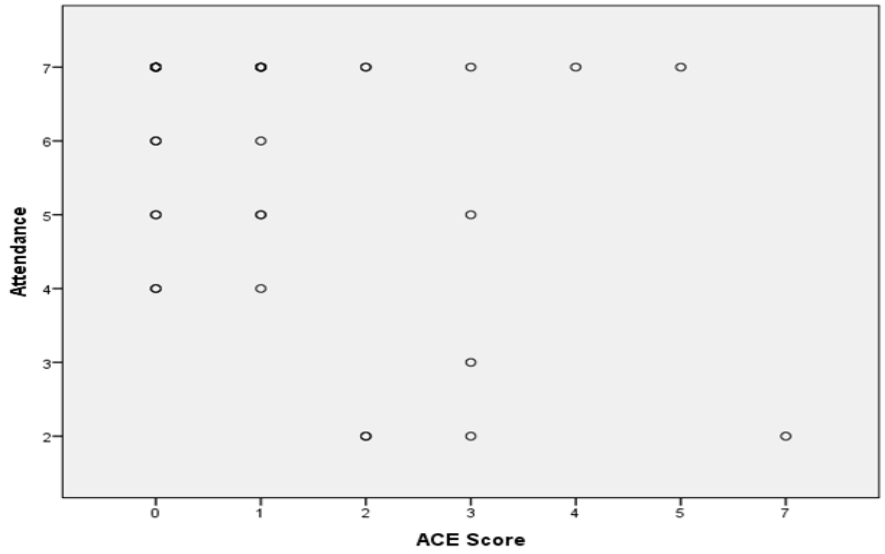



Figure 8: Spanish linear relationship scatterplot



Although no strong linear relationship between high ACE scores and the attendance rate of the participants was apparent, even when separated by English and Spanish speaking participants/groups, a linear regression analysis was used to further explore any predictive relationship. The linear regression model did not show any statistically significant findings that there is a relationship between high ACE or PACE scores and attendance rates. The linear regression for both groups combined is shown in figure 9.

Figure 9: Linear Regression ACEs, PACEs and attendance scores

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .106[a] | .011 | .000 | 1.643 |

**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | | |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | t | Sig. |
| 1 | (Constant) | 5.986 | .224 | | 26.760 | .000 |
| | ACEScore | -.065 | .064 | -.106 | -1.016 | .312 |
| | PACEscore | .035 | .074 | .050 | .481 | .632 |

An F test was also conducted to establish if there was a significate variance in the means as shown in figure 10. There was not a significant difference found in the variances of the sample means when looking at ACEs and well as PACEs.

Figure 10: F test English and Spanish combines, ACEs, and PACEs

**F Test within the Samples (ACES)**

Attendance

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 40.096 | 9 | 4.455 | 1.774 | .086 |
| Within Groups | 208.484 | 83 | 2.512 | | |
| Total | 248.581 | 92 | | | |

**F Test within the Samples (PACEs)**

Attendance

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 23.550 | 8 | 2.944 | 1.099 | .372 |
| Within Groups | 225.031 | 84 | 2.679 | | |
| Total | 248.581 | 92 | | | |

In order to evaluate if there was a difference in the linear regression when looking within the English group and Spanish group, linear regressions were run separately. Figure 11 indicates the English-speaking group's ACE score, PACE score, and attendance linear regression. As shown below, there was not a statistically significant finding for wither the ACE score or the PACE score when looking at the English group alone. The significant level for ACE scores was at .72 and the PACE scores .93, neither of which would indicate a significant finding at a 95% confidence level.

Figure 11: English group linear regression-ACEs and PACEs

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .054[a] | .003 | -.040 | 1.668 |

**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | | |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | t | Sig. |
| 1 | (Constant) | 5.582 | 1.096 | | 5.093 | .000 |
| | ACE Score | .032 | .089 | .058 | .357 | .723 |
| | PACE score | .010 | .120 | .013 | .082 | .935 |

The F test when including only the English group did not show a significance in variance in the means, as indicated in figure 12.

Figure 12: F test for English group- ACEs and PACEs

**F Test English only- ACEs**

Attendance

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 26.456 | 9 | 2.940 | 1.123 | .369 |
| Within Groups | 104.664 | 40 | 2.617 | | |
| Total | 131.120 | 49 | | | |

**F test English only- PACEs**

Attendance

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 16.481 | 8 | 2.060 | .737 | .659 |
| Within Groups | 114.639 | 41 | 2.796 | | |
| Total | 131.120 | 49 | | | |

When looking at the Spanish group separately, there does appear to be a relationship between high ACE scores and the attendance of the participants. Figure 11 shows that the relationship is statistically significant at .004 using a 95% confidence interval.

Figure 13: Spanish group linear regression- ACEs

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .427[a] | .182 | .162 | 1.526 |

**Coefficients[a]**

| | | Unstandardized Coefficients | | Standardized Coefficients | | |
|---|---|---|---|---|---|---|
| Model | | B | Std. Error | Beta | t | Sig. |
| 1 | (Constant) | 6.417 | .283 | | 22.675 | .000 |
| | ACE Score | -.455 | .151 | -.427 | -3.024 | .004 |

An F test was also conducted with the Spanish group ACE score data to establish if there was any significant variance in the means for this data set. As shown in figure 14 there is a statistical significance in the variance of the means for this group when looking at ACEs. Figure 15 shows no statistically significant variance when looking at PACEs.

Figure 14: F test for Spanish data- ACEs

**F test Spanish data- ACEs**

Attendance

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 43.986 | 6 | 7.331 | 3.625 | .006 |
| Within Groups | 72.805 | 36 | 2.022 | | |
| Total | 116.791 | 42 | | | |

Figure 15: F test for Spanish data- PACEs

**F test Spanish data-PACEs**

Attendance

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 27.873 | 8 | 3.484 | 1.332 | .261 |
| Within Groups | 88.917 | 34 | 2.615 | | |
| Total | 116.791 | 42 | | | |

An interaction model was also run on the data to determine if the PACEs showed a modifying effect on the effects of the ACEs. Figure 16 indicates PACEs have no statistically significant effect on the ACEs and attendance rates.

Figure 16: Interaction Regression

**Model Summary[b]**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .121[a] | .015 | -.019 | 1.659 |

**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | | |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | t | Sig. |
| 1 | (Constant) | 5.619 | .764 | | 7.350 | .000 |
| | ACEs_PACEs | -.015 | .029 | -.154 | -.493 | .623 |
| | ACEScore | .030 | .195 | .049 | .152 | .879 |
| | PACEscore | .051 | .099 | .073 | .516 | .607 |

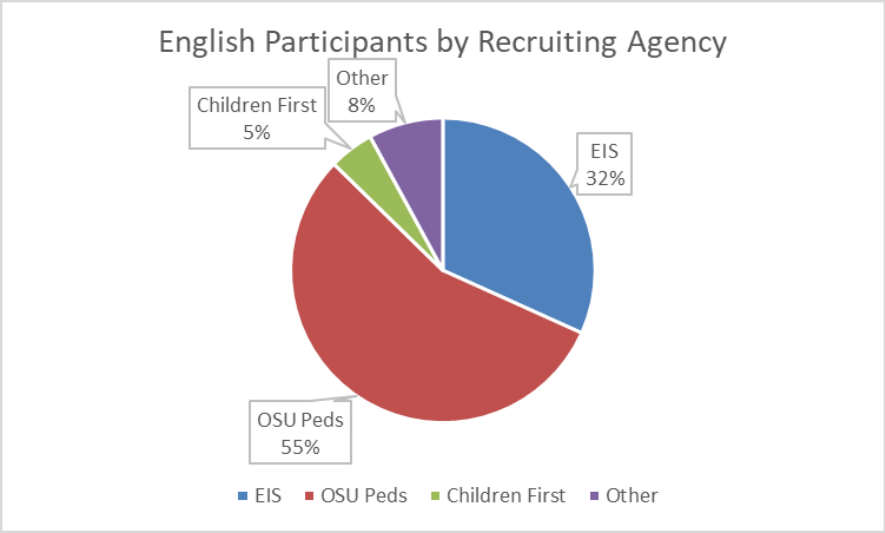
## Discussion

Based on existing literature there was a connection between the effects of high ACE scores and the life skills needed to participate in longitudinal studies, such as working memory and executive functioning. It was thought that if there was a strong relationship between high ACE scores and attendance rates, researchers would be able to use this relationship to help predict retention rates within a study. In addition to being able to predict retention rates within a study, showing that high PACE scores had a buffering effect on the high ACE scores could also provide researchers with information on how to retain their participants by providing them with additional support while they are participants in the study. While a relationship between high

ACE scores and retention rates was not found within this entire sample, it is believed that the logic behind the hypothesis was sound, based on the current research surrounding ACEs and their effects on working memory and executive functioning. A connection was found between high ACE scores and attendance for the Spanish group when the sample was separated. Further research into the connection between high ACE scores and low rates of participation in research studies should be conducted with a larger sample size, and a more complete data set to see if indeed a relationship does exist.

There are several limitations to this study, which may have had an impact on the data, reducing the connection between high ACE scores and retention rates when looking at the sample as a whole. The first limitation is that of the timing if the implementation of the ACEs and PACEs questionnaires. As mentioned, at the baseline survey, these questionnaires were not administered. There are a large number of participants, particularly in the English treatment group, that did not come to any more assessments after their initial baseline survey. There is no way of knowing at this point if those participants did indeed have high ACE scores, but it can be speculated that they did, based on where the majority of recruitments for that group came from. Most of the participant recruitments for the English treatment group came from Emergency Infant Services which would indicate that they are living in poverty and do not have the necessary resources to care for their baby. Another large recruitment organization was OSU pediatrics, which serves a large number of low-income clientele. Figure 17 indicates English participants by recruiting agency.

Figure 17: English participants by recruiting agency




Oklahoma has consistently presented with a high number of children being exposed to ACEs, leading the nation in number of incarcerations, especially incarcerated women, for a number of years[30]. Oklahoma has also lead the nation in divorce rates[31], and the percentage of children experiencing abuse or neglect has continued to rise over the past decades, 16% of the population reported child abuse or neglect in 2017[32]. The prevalence of child abuse and neglect, as well as divorce in the state of Oklahoma serves to further the assumption that the participants' ACE scores are most likely higher than initially reported.

Another limitation of the study is the sensitive nature of the ACE questionnaire itself. Many people do not always report their actual adverse childhood experiences because they do

[30] Oklahoma Department of Corrections. Accessed April 2019. http://doc.ok.gov/

[31] Worldatlas.com. Accessed April 2019. https://www.worldatlas.com/articles/10-us-states-with-the-highest-divorce-rates.html

[32] Kids Count Data Center. Accessed April 2019. https://datacenter.kidscount.org/data/tables/5514-current-child-abuse-neglect confirmations?loc=38&loct=2#detailed/2/any/false/871,870,573,869,36,868,867,133,38/any/12090,12091

not want other people to know about them. This is especially true in the Hispanic culture as these topics are often not talked about within their own families, and certainly would not be disclosed to a stranger, even with the explanation of confidentiality. There were several Hispanic participants that reported 0 ACEs. It is felt that is highly unlikely as many of these participants were immigrants from very destitute and lawless areas of Mexico, where, as children, they were very likely to see, hear, or experience these adverse childhood experiences. Unfortunately, there is little that can be done to help participants feel more comfortable answering these questions, especially if the ideal time for filling out these questionnaires is at the first assessment, when the participant has not built any type of trust with the researchers administering the questionnaires.

## Conclusion

Although the data in this study did not support the hypothesis entirely, it is believed that understanding the trauma that a participant has endured in their lifetime can help researchers better understand how to retain participants in their studies in the future. Understanding the life experiences of a participant can help researchers to identify potential triggers that might keep a person from coming back for additional data collection, as well as preemptively collecting additional contact information/best method of contact for future data collection.

It is easy as researchers to continuously look at numbers of participants and the data collected during a study, and forget the human aspect behind the data that is collected. Participants in research studies bring to the table their experiences as human beings that then is quantified as data in research projects. It is important for researchers working with human populations to remember the human aspect of the data, and consider that when strategizing about how to retain participants in longitudinal studies. If they can keep the human aspect in mind, they

might be able to cater their assessments processes, content, resources, etc. to their population to boost retention rates.

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# Appendix 1: ACES Questionnaire

**When you were growing up, prior to your 18th birthday:**

1. Did a parent or other adult in the household often, or very often: Swear at you, insult you, put you down, or humiliate you OR aact in a way that made you afraid you might be physically hurt? YES NO
2. Did a parent or other adult in the household often or very often: Push, grab, slap, or throw something at you OR hit you so hard that you had [illegible] YES NO
3. Did an adult or person at least 5 years older than you ever: Touch or fondle you or have you touch their body in a sexual way OR attempt or actually have oral, anal, or vaginal sexual intercourse with you? YES NO
4. Did you often or very often feel that: No one in your family lived you or thought you were important or special OR your family didn't look out for each other, feel close to each other, or support each other? YES NO
5. Did you often or very often feel that: You didn't have enough to eat, had to wear dirty clothes, and had no one to protect you OR your parents were too drunk or high to take care of you or take you to the doctor if you needed it? YES NO
6. Was your mother or stepmother or father or stepfather: Often or very often pushed, grabbed, slapped, or had something thrown at her/him OR sometimes, often, or very often kicked, bitten, hit with a fist, or hit with something hard OR ever repeatedly hit for at least a few minutes or threatened with a gun or knife? YES NO
7. Did you live with anyone who was a problem drinker or alcoholic or who used street drugs or prescription drugs as not prescribed? YES NO
8. Was a household member depressed or mentally ill, or did a household member attempt suicide? YES NO
9. Did a household member go to prison? YES NO
10. Were your parents ever separated or divorced? YES NO

# Appendix 2: PACES Questionnaire

**When you were growing up, prior to your 18th birthday:**

| | | |
|---|---|---|
| I. | Did you have someone who loved you unconditionally (you did not doubt that they cared about you)? | YES NO |
| 2. | Did you have at least one best friend (someone you could trust, had fun with)? | YES NO |
| 3. | Did you do anything regularly to help others (e.g., volunteer at a hospital, nursing home, church) or do special projects in the community to help others (food drives, Habitat for Humanity)? | YES NO |
| 4. | Were you regularly involved in organized sports groups (e.g., soccer, basketball, track) or other physical activity (e.g., competitive cheer, gymnastics, dance, marching band)? | YES NO |
| 5. | Were you an active member of at least one civic group or a non-sport social group such as scouts, church, or youth group? | YES NO |
| 6. | Did you have an engaging hobby -- an artistic or intellectual pastime either alone or in a group (e.g., chess club, debate team, musical instrument or vocal group, theater, spelling bee, or did you read a lot)? | YES NO |
| 7. | Was there an adult (not your parent) you trusted and could count on when you needed help or advice (e.g., coach, teacher, minister, neighbor, relative)? | YES NO |
| 8. | Was your home typically clean AND safe with enough food to eat? | YES NO |
| 9. | Overall, did your schools provide the resources and academic experiences you needed to learn? | YES NO |
| 10. | In your home, were there rules that were clear and fairly administered? | YES NO |

## Biography

Mallory Branch is currently working at Oklahoma State University in Tulsa as the Project Coordinator for the Morris Child and Adolescent Development Lab (CAD Lab). In her current role, she coordinates the running of several projects under the umbrella of the CAD Lab, including budgeting. Managing and training of staff, and implementation of research protocols.

Mallory received her Bachelor of Science degree in Human Development and Family Science from Oklahoma State University and a Master of Science in Research Administration for Johns Hopkins University.

Mallory has been working in the research field since July 2014. She began her career in research with an undergrad internship spring of 2014. She began as a child assessor and data manager in July 2014 working on the CAP Family life Study at Oklahoma State University. She then took on the role of training other child assessors, as well as parent surveyors to implement data collection procedures. In addition to training Mallory was also in charge of scheduling participants for data collection, and managing and cleaning the data collected.

Mallory has also been involved in the coordinating and implementation of the Legacy for Children project evaluation. Legacy for children is a parenting program developed by the CDC to help provide families with a support system and knowledge about their developing babies, as well as parenting strategies. Mallory coordinated the assessment evaluations, scheduling participants, and trained research assistants on how to conduct assessments. Mallory also trained on Parenting Interactions with Children: Checklist of Observations linked to Outcomes (PICCOLO) coding and coded the parent/child interaction videos recorded during these assessments.

Mallory also took on the role of program coordinator for Oklahoma's University for Parents, an organization aimed at helping to disseminate information learned from research to parents in a way that they can understand, to help promote the healthy development of children and their families. Mallory has helped to promote the parent education events, coordinate staff and presenters, and many other aspects of running events. Mallory is passionate about helping parents understand their child's current development and how they can promote the further healthy development of their children.